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SUMMARY

Problem

From an epidemiologic perspective, very little is known about the agent, host, and environment of combat casualties. Such information is particularly important in planning for medical treatment procedures and facilities which pertain to combat personnel in a military theater of operations.

Objective

The objective of the paper is to provide a descriptive account of four distinct aspects of combat casualties among Marine Corps personnel in Vietnam between 1964 and 1972: (1) types of personnel injured in battle; (2) types of injuries; (3) wounding agents; and (4) the flow of patients into and from medical facilities in Vietnam.

Approach

The Marine Corps Inpatient Medical Data File at the Naval Health Research Center was searched for all hospital admissions which were identified as a battle wound or injury. Combat casualties were defined as those hospitalizations with an ICDA-8 diagnosis of accidents, poisonings and violence, and a cause code of battle wound or injury. Diagnoses were grouped into categories of injuries such as fractures, contusions, burns, open wounds of the head, trunk, upper and lower limbs, and multiple open wounds. Age, sex, pay grade, length of service, race, military occupational specialty, unit identification code, wounding agent, reporting facility, type of admission, and patient disposition upon discharge also were identified.

Results

The Marine Corps Inpatient Data File for the period between 1964 and 1972 contains the records of 78,756 Marines who were wounded or injured in combat in Vietnam. Altogether, these individuals accounted for 120,017 battle-related first hospitalizations with one or more diagnoses of accidents, poisonings and violence. Almost all of the Marines wounded in Vietnam were young (under the age of 25), junior enlisted infantrymen with three years or less of service. The First and Third Marine Divisions accounted for the majority of casualties. Multiple open wounds and open wounds of the lower limbs were the most common primary diagnoses. Altogether, bullets, mines and booby traps were responsible for more than half of the wounds and injuries. Three-fourths of the casualties were treated at a Naval hospital, hospital ship, dispensary, or the Naval Support Activity in Da Nang. Marine battalion aid stations and field hospitals accounted for the second largest percentage of casualties treated. More than half of these admissions were direct from the battlefield while the remainder were transfers from other medical facilities. The mortality rate of wounded patients was much lower than has been reported for Army casualties in Vietnam or casualties in previous conflicts.

Conclusions

Because population at risk could not be determined, relatively little can be said about risk factors for combat casualties based on this study. It is also difficult to genera-

alize about combat casualties based on the Vietnam experience. However, while only descriptive in nature, the data contained in the Marine Corps Inpatient Data File reflect the demands placed on medical facilities in a military theater of operations and present a picture of the types of wounds which may be expected from certain types of weapons as well as the characteristics of wounded personnel.

Recommendations

In order to provide a complete picture of morbidity and mortality during military conflicts and the demand placed on Navy and Fleet Marine Force medical resources, future studies should concentrate on psychiatric casualties and disease and non-battle injuries (DNBI) among Navy and Marine Corps personnel.

Combat Casualties Among U.S. Marine Corps Personnel in Vietnam: 1964-1972

Morbidity and mortality due to enemy action in wartime has usually been expressed, with varying degrees of accuracy, in terms of the numbers killed and wounded in action. This information has been recorded in official military histories, hospital records, and unit diaries, and summarized in numerous books and reports in attempts to measure the quantity and quality of medical care provided and to provide lessons for future wars (1-3). However, as Henderson (4) observes, few attempts have been made to incorporate epidemiologic methods into development of coherent policies governing the management of combat casualties. From an epidemiologic perspective, we know very little about the agent, host, and environment of combat casualties. Such information is particularly important in planning for the logistics of medical treatment and facilities to support personnel in combat.

The records of the Vietnam conflict provide an opportunity to conduct a preliminary examination of the epidemiology of combat casualties. The war in Vietnam can be regarded as a unique experience from a military perspective. Large-scale engagements were few and most combat occurred in a jungle environment. There were no front lines and control of territory constantly shifted back and forth between opposing forces (5,6). Guerrilla tactics, an inability to clearly distinguish friends from enemies (7), ubiquity of booby traps (6,8), use of new technology in combat such as chemical defoliants (Agent Orange) (6,9), waning popular support (10), and the lack of unit cohesion among military units (9-12), all characterized the combat environment in Vietnam. The high incidence of drug and alcohol abuse may also have contributed to decreased vigilance in battle and increased risk of combat casualties among American servicemen (13,14).

Despite the relatively unique set of circumstances, however, an examination of the combat casualties suffered by U.S. Marine Corps personnel in Vietnam can help to identify the information necessary for the provision of adequate medical care and contingency planning in military theaters of operations. Although the admission rate for battle wounds among Marine Corps personnel in Vietnam was lower than the rates during World Wars I and II, for the first time since World War I, trauma in and out of battle was the largest single cause of hospitalization. Battle casualties accounted for more than one-third of injury admissions (15). This paper will attempt to provide a descriptive account of four distinct aspects of combat casualties among Marine Corps personnel in Vietnam between 1964 and 1972: (1) types of personnel injured in battle; (2) types of injuries; (3) wounding agents; and (4) the flow of patients into and from medical facilities in Vietnam.

METHODS

The Naval Health Research Center maintains an Inpatient Medical Data File on all hospitalizations recorded for active duty U.S. Marine Corps personnel for the period 1964-1972. This file was searched for all first hospital admissions which were identified as a battle wound or injury. Combat casualties were defined as those hospitalizations with a diagnosis of accidents, poisonings, and violence (APV), and a cause code of battle wound or injury. Diagnoses were in accordance with the Eighth Revision, International Classification of Disease Adapted for Use in the United States (ICDA-8). Cause code refers to the

class of trauma (battle wound or injury, intentionally inflicted nonbattle injury, and accidental injury) for accidents, poisonings, and violence. Diagnoses were grouped into categories of injuries such as fractures, contusions, open wounds of the head, and multiple open wounds. Age, sex, pay grade, length of service, race, military occupational specialty (MOS), and unit identification code of casualties were also identified from this file. As only a small number of women Marine Corps personnel were present in Vietnam during this period, only men were considered in this study. Military occupational specialties or job codes were grouped into major divisions such as infantry, artillery, administrative, and air support. Unit identification codes also were grouped to better define duty stations at the time of injury. Age, pay grade, and length of service were grouped for statistical analyses. A cross tabulation procedure was employed to determine the distribution of injury groups by diagnosis number (primary, secondary, etc.), age, pay grade, and MOS. Comparisons of primary diagnostic categories among age, pay grade, and occupational groups were made using chi square tests to determine if differences were statistically significant. Calculation of injury rates and the assessment of risk, however, was not possible because of the lack of population data on U.S. Marines who were at risk for combat casualties.

Also identified from this inpatient file was information pertaining to the wounding agent and the flow of patients to and from medical facilities. Each diagnosis contains a cause code indicating whether the injury was due to bullets, mines, grenades, artillery shells, and so on. Wounding agents were grouped for ease of statistical analyses and cross-tabulated with categories of primary diagnoses. In addition, each patient record indicates whether the admission was a direct one from the battlefield or a transfer from another medical facility. The type of medical facility reporting the casualty and the destination of the patient after leaving the reporting facility are also available from the inpatient record.

RESULTS

Characteristics of Casualties

The Marine Corps Medical Inpatient Data File for the period between 1964 and 1972 contains the records of 78,756 Marines who were wounded or injured in combat in Vietnam. Altogether, these individuals accounted for 120,017 battle-related diagnoses of accidents, poisonings, and violence.¹ A descriptive summary of these individuals is provided in Table 1. A large percentage of casualty victims (89.9%) was under the age of 25. Whites accounted for 86 percent of these casualties. Privates and lance corporals accounted for the large majority of casualty victims while senior enlisted personnel and warrant officers accounted for the smallest percentage (only 21 warrant officers were listed as having been wounded in battle). Most of the casualties were infantrymen, followed by construction, artillery, and operations personnel. The First Marine Division accounted for half of the casualties, followed by the Third Marine Division. Other units combined accounted for 8.1 percent, but individually no unit other than the ones specified in the table accounted for more than one percent of the total casualties.

When the year in which the hospitalization occurred is examined, a bell curve is indicated with the number of casualties reaching a peak in 1968, the year of the TET offensive. The official involvement of U.S. Marines in Vietnam began on March 8, 1965 with the landing of units of the 3rd Fleet Marine Force at Da Nang and ended in April 1971.

Table 1
Casualties by Demographic and Service History Variables
U.S. Marines in Vietnam, 1964-1972

Age	N	%
17-19	20,574	26.1
20-24	50,233	63.8
25-29	3,889	4.9
30-34	1,255	1.6
35-39	595	0.8
40+	311	0.4
Missing Data	1,899	
Race		
Caucasian	67,955	86.3
Black	10,329	13.1
All Other	472	0.6
Pay Grade		
E1-E3	57,462	73.1
E4-E6	17,589	22.4
E7-Warrant Officers	631	0.8
Officers	2,911	3.7
Missing Data	163	
Years Served		
1 year or less	47,176	59.9
2 years	16,897	21.5
3 years	5,729	7.3
4-5 years	2,790	3.5
6-7 years	1,160	1.5
8-9 years	783	1.0
10 years or more	2,215	2.8
Missing Data	2,006	
Military Occupation		
Administration	867	1.2
Intelligence	726	1.0
Infantry	62,071	83.5
Artillery	3,090	4.2
Utilities	763	1.0
Construction	3,491	4.7
Operations	2,709	3.6
Aviation Support	352	0.5
Pilots	248	0.3
Missing Data	4,439	
Military Units		
First Marine Division	39,407	50.1
Third Marine Division	30,214	38.4
HQ 3rd Marine Amphib	1,291	1.6
Ninth Marine Brigade	1,410	1.8
Other Units	6,380	8.1
Missing Data	54	
Year Wounded		
1964	7	.0
1965	806	1.0
1966	7,883	10.0
1967	20,501	26.0
1968	26,287	33.0
1969	17,410	22.1
1970	5,639	6.8
1971	485	0.6
1972	C	.0

Types of Injuries

Table 2 provides a description of the types of injuries and an index of severity or priority of diagnosis. Multiple open wounds accounted for the largest percentage of injuries, followed by fractures, open wounds of the lower limbs, and contusions. In looking at primary diagnoses, however, open wounds of the upper limbs account for a large percentage of injuries.

Table 2

Combat Casualties by Diagnosis Priority and Diagnostic Group
U.S. Marines in Vietnam, 1964-1972

Diagnostic Group	Primary		Diagnosis Number				Other		Total	
	N	%	Secondary				N	%	N	%
Fractures	6,150	7.8	9,192	37.4	4,703	28.2	20,045	16.7		
Strains, Sprains	855	1.1	353	1.4	200	1.2	1,408	1.2		
Contusions	5,534	7.0	4,884	19.9	5,052	30.3	15,470	12.9		
Open Wound Head	3,685	4.7	1,594	6.5	1,542	9.3	6,821	5.7		
Open Wound Trunk	4,722	6.0	608	2.4	440	2.6	5,770	4.8		
Open Wound Upper Limb	10,620	13.5	1,498	6.1	969	5.8	13,087	10.9		
Open Wound Lower Limb	16,569	21.0	2,265	9.2	1,250	7.8	20,084	16.7		
Multiple Open Wounds	27,766	35.3	2,458	10.0	1,211	7.3	31,435	26.2		
Burns	1,048	1.3	243	1.0	155	0.9	1,446	1.2		
Amputations	1,438	1.8	859	3.5	382	2.3	2,679	2.2		
All Other APV	369	0.5	643	2.6	760	4.6	1,772	1.5		
Total	78,756	100.0	24,597	100.0	16,664	100.0	120,017	100.0		

When primary diagnoses are examined in relation to total diagnoses, it would appear that the diagnostic categories which have the highest proportion of primary diagnoses are open wounds, burns, sprains and strains, and amputations (which is itself an open wound). Fractures, contusions, and other diagnoses of accidents, poisonings, and violence were not often the primary diagnosis on first admission of a casualty to a medical treatment facility.

The diagnostic groups were further examined to determine if any apparent differences in the distribution of primary diagnoses could be discerned with respect to age, pay grade, and military occupational specialty. A cross tabulation of primary diagnoses by age is provided in Table 3. Casualties who were 25 years of age or older appear to have higher percentages of fractures, strains, and sprains than casualties who were younger than 25. There also is a slight percentage increase with respect to age for open head wounds and slight percentage decreases with respect to age for open wounds of the upper and lower limbs.

Table 3

Combat Casualties by Age and Primary Diagnoses
U.S. Marines in Vietnam, 1964-1972

Diagnostic Group	17-19		20-24		25+	
	N	%	N	%	N	%
Fractures	1,609	7.3	3,757	7.5	596	9.8
Strains, Sprains	208	1.0	504	1.0	111	1.8
Contusions	1,465	7.1	3,455	6.9	427	7.1
Open Wound Head	904	4.4	2,392	4.8	296	4.9
Open Wound Trunk	1,244	6.0	3,051	6.1	308	5.1
Open Wound Upper Limb	2,809	13.7	6,808	13.6	768	12.7
Open Wound Lower Limb	4,357	21.2	10,570	21.0	1,264	20.9
Multiple Open Wounds	7,181	34.9	17,933	35.7	2,051	33.9
Burns	262	1.3	662	1.3	102	1.7
Amputations	435	2.1	870	1.7	94	1.5
All Other APV	100	.5	225	.4	33	.8
Total	20,574	100.0	50,233	100.0	6,050	100.0

$$\chi^2 = 122.21; \text{ d.f.} = 20; \text{ p.} < .0001$$

Table 4 provides a cross tabulation of diagnostic groups by pay grade. Senior enlisted personnel and warrant officers display the highest percentages of fractures, strains,

sprains, and open head wounds among the four groups but the lowest percentage of open trunk wounds. Officers display the highest percentages of open wounds of the lower limbs and burns. Privates and lance corporals (E1-E3) display the highest percentages of contusions, open wounds of the upper limbs, multiple open wounds, and amputations. There also are slight percentage increases with respect to pay grade for fractures and burns, and slight percentage decreases with respect to pay grade for contusions and amputations.

Table 4

Combat Casualties by Pay Grade and Primary Diagnoses
U.S. Marines in Vietnam, 1964-1972

Diagnostic Group	E1-E3		E4-E6		Pay Grade Senior Enlisted & Warrant Officers		Officers	
	N	%	N	%	N	%	N	%
Fractures	4,243	7.4	1,517	8.5	80	12.7	295	10.1
Strains, Sprains	567	1.0	227	1.3	14	2.2	42	1.4
Contusions	4,067	7.1	1,222	6.9	79	6.2	183	6.5
Open Wound Head	2,678	4.7	828	4.7	41	6.5	133	4.6
Open Wound Trunk	3,428	6.0	1,095	6.2	23	3.6	165	5.7
Open Wound Upper Limb	7,788	13.6	2,348	13.3	85	13.5	379	13.0
Open Wound Lower Limb	12,008	20.9	3,754	21.3	113	17.9	657	22.6
Multiple Open Wounds	20,611	35.9	5,954	33.9	216	34.2	936	32.2
Burns	730	1.3	245	1.4	11	1.7	61	2.1
Amputations	1,074	1.9	318	1.8	7	1.1	37	1.3
All Other APV	268	0.5	80	0.5	2	0.3	18	0.5
Total	57,462	100.0	17,589	100.0	631	100.0	2,911	100.0

$\chi^2 = 162.80$; d.f. = 30; p. < .0001

A cross tabulation of primary diagnoses by military occupational specialty is provided in Table 5. Occupational groups appear to differ with respect to the distribution of diagnoses. Multiple open wounds account for the largest percentage of casualty diagnoses among all occupational groups with the exception of pilots and aviation support personnel. Among these two groups, open wounds of the lower limbs account for the largest percentage of diagnoses. Pilots also appear to have a much higher percentage of fractures, strains, sprains, and burns, but lower percentages of open trunk wounds, multiple open wounds, and

Table 5

Combat Casualties by Military Occupational Specialty and Primary Diagnosis
U.S. Marines in Vietnam, 1964-1972

Diagnostic Group	Military Occupational Specialty								
	Infantry N=62,071	Admini N=1,142	Intell N=726	Artill N=3,090	Utilit N=763	Constr N=3,491	Operat N=2,709	Aviat N=352	Pilot N=248
	%	%	%	%	%	%	%	%	%
Fractures	7.2	10.5	9.1	10.1	12.6	11.9	8.7	9.4	17.7
Strains, Sprains	0.9	3.5	1.5	2.1	1.4	2.0	1.2	2.8	3.2
Contusions	6.6	7.1	5.4	8.9	7.7	7.3	7.8	4.8	5.6
Open Wound Head	4.5	6.0	4.7	5.6	5.6	6.4	4.5	2.8	3.2
Open Wound Trunk	6.2	5.8	5.6	5.4	5.1	4.4	5.6	6.0	2.4
Open Wound Upper Limb	13.9	12.1	13.1	11.1	12.7	11.8	12.6	14.2	10.9
Open Wound Lower Limb	21.6	20.0	19.4	16.8	17.8	17.3	20.0	29.3	32.3
Multiple Open Wounds	35.3	30.0	37.2	32.6	28.6	33.5	36.7	23.6	15.7
Burns	0.9	2.5	1.7	5.6	5.6	2.9	1.0	5.7	7.3
Amputations	1.9	2.0	1.8	1.5	2.2	1.8	1.5	1.1	0.8
All Other APV	0.5	0.5	0.6	0.3	0.5	0.7	0.5	0.3	0.8

$\chi^2 = 1511.11$; d.f. = 80; p. < .0001

amputations, than do other occupational groups. Construction personnel appear to have a higher percentage of open head wounds than do other groups. Artillery, aviation support, and utilities personnel have higher percentages of burns than do other groups.

Wounding Agent

Table 6 provides a list of wounding agents responsible for each of the diagnostic categories of primary battle casualty diagnoses. As the last column of the table indicates, mines, booby traps and bullets accounted for the largest number of total casualties. Mines and booby traps also were responsible for the largest percentages of fractures, contusions, open head wounds, open wounds of the lower limbs, multiple open wounds, burns, and amputations. Bullets were responsible for large percentages of fractures, contusions, open head wounds, open wounds of the trunk, open wounds of the upper and lower limbs, and all other injuries. Fires and explosions on ships, aircraft or on land which were secondary or indirect effects of the instrumentalities of war were responsible for large percentages of burns, contusions, and strains and sprains.

Table 6
Combat Casualties by Wounding Agent
U.S. Marines in Vietnam, 1964-1972

<u>Wounding Agent</u>	<u>Primary Diagnosis</u>							
	Fractures	Strains Sprains	Contusions	Open Wound Head	Open Wound Trunk	Open Wound Upper Limbs		
	%	%	%	%	%	%		
Artillery	1.2	0.6	1.2	1.0	1.1	0.9		
Rockets/Bombs	3.0	2.7	2.2	3.6	1.8	2.0		
Shell Fragments/Unspecified	10.6	4.0	10.9	16.0	16.7	17.5		
Mortars/Bazookas	9.7	6.1	10.8	12.1	10.8	11.5		
Mines/Booby Traps	21.6	13.8	20.7	28.4	15.8	18.4		
Grenades	5.1	3.0	5.5	8.7	6.1	5.8		
Bullets	34.9	6.8	22.9	20.8	44.3	40.5		
Bayonets	0	0.1	0.1	0	0.3	0.2		
Incendiary/Flame Throwers	0.1	0	0.1	0	0	0		
Fires/Explosions	10.2	60.8	21.6	6.3	0.3	0.6		
All Other Agents	3.6	2.1	3.9	3.3	2.7	2.4		
	Open Wound Lower Limbs	Multiple Open Wounds	Burns	Amputations	All Other APV	Total Casualty Diagnoses		
	%	%	%	%	%	%	N	
Artillery	0.8	0.9	0.6	0.9	0.8	0.9	733	
Rockets/Bombs	2.1	2.2	3.0	2.8	3.8	2.3	1,827	
Shell Fragments/Unspecified	16.3	18.2	1.9	6.7	16.0	15.8	12,477	
Mortars/Bazookas	10.3	15.4	4.1	7.4	10.6	12.2	9,606	
Mines/Booby Traps	23.0	37.3	27.3	54.9	16.0	27.5	21,644	
Grenades	6.5	8.4	3.6	7.6	6.0	6.9	5,467	
Bullets	36.9	14.9	2.2	10.4	28.2	26.9	21,156	
Bayonets	1.1	0	0	0.1	0	0.3	238	
Incendiary/Flame Throwers	0	0	3.3	0.1	0.3	0.1	62	
Fires/Explosions	0.6	0.3	50.8	3.5	15.4	4.4	3,493	
All Other Agents	2.2	2.2	3.2	5.4	3.0	2.6	2,053	

Patient Flow

As indicated in Table 7, more than one-half of the combat casualties recorded were treated at a Naval hospital or hospital ship. Marine battalion aid stations and field hospitals accounted for the second largest percentage of casualties treated, followed by the Naval Support Activity in Da Nang. More than half of these first admissions were direct from

the battlefield while the remainder appear to consist of transfers from other medical facilities. These data, however, reflect the lack of records for early treatment of casualties. Moreover, there is no indication that Marines treated and discharged from medical facilities of other branches of the military are included in these data. Of those treated for battle injuries who are in the file, about 45 percent were discharged from the reporting facility while 1.4 percent of those admitted died as a result of their wounds (DOW) at that facility. The remainder were transferred to other medical facilities in the United States, Clark Air Force Base in the Philippines, or other service facilities in the Pacific area.

Table 7
Treatment Facilities, Type of Admission, and Disposition of U.S. Marine
Combat Casualties in Vietnam, 1964-1972

<u>Treatment Facility</u>	<u>N</u>	<u>%</u>
Naval Hospital/Hospital Ship	40,421	51.3
Naval Support Activity, Da Nang	15,113	19.2
Dispensaries	137	0.2
Helicopter Ships	2,512	3.2
Marine Groups	19,695	25.0
Unknown	878	1.1
<u>Type Admission</u>		
Direct	43,459	55.2
Transferred from Other Facility	35,267	44.8
<u>Disposition</u>		
Evacuated to CONUS	10,663	13.5
Transferred to Navy Hospital	8,868	11.3
Transferred to Army Hospital	579	0.7
Transferred to Air Force Hospital	20,925	26.6
Transferred to VA Hospital	1,214	1.5
Transferred to Civilian Hospital	36	0.0
Discharged from Hospital	35,385	44.9
Died of Wounds (DOW)	1,066	1.4

DISCUSSION

Military epidemiologists have traditionally relied upon historical disease trends among active duty personnel to predict the medical requirements of future military actions and to estimate the impact of casualty rates on effective military operations (15). Reducing morbidity and mortality in the combat zone is the principal mission of supporting medical organizations. For medical support planning, morbidity, not mortality, is the primary determinant of medical workload in a combat theater of operations (16).

The data presented in this paper reflect the workload of Navy medical units in Vietnam resulting from combat casualties among Marine Corps personnel between 1964 and 1972. (Disease and Non-battle Injuries (DNBI) will be treated in a subsequent study). However, for several reasons these data tell us very little about the epidemiology of combat injury among Marine Corps personnel. While the data indicate the number of wounded who died while in a medical care facility, they provide an incomplete count of combat deaths because only hospitalized inpatients are included. In addition, a complete census of the population at risk was unavailable at the time of study. This prevented the calculation of injury rates which are essential if assessment of risk factors such as age, pay grade,

and military occupational specialty are to be made. Finally, Marines who were treated and discharged from Army and Air Force medical facilities in Vietnam may not be included in the file, resulting in an incomplete count of combat injuries.

Despite these limitations, however, several interesting points emerge. Most of the Marines wounded in Vietnam were young (under the age of 25), junior enlisted infantrymen with three years or less of service. The First and Third Marine Divisions accounted for the majority of casualties. Multiple open wounds and open wounds of the lower limbs were the most common primary diagnoses. This was due in large part to the widespread use of mines and booby traps by enemy forces and the destructive firepower of new weapons. Hardaway (17) reported in 1967 that most of the battle injuries treated at military facilities in Vietnam were due to fragments of mines, mortars, or other explosive devices and that the numbers of wounds per patient were amazingly large. A 1968 study of American casualties showed that between January 1967 and September 1968, 23.7 percent of U.S. deaths were caused by mines and booby traps. The Marines in I CTZ (Corps Tactical Zone) experienced 41 percent of their killed in action (KIA) from this source in July of 1969, a period of low combat intensity (6). Fractures and contusions were typically not the primary injury of a battle casualty.

Although, as noted above, no accurate assessment of risk is possible, some trends are evident and merit further research. The types of injuries suffered by personnel differed with respect to age, pay grade, and military occupational specialty. In order to determine whether any of these characteristics constitutes a risk factor for a combat injury, however, complete census counts of the population at risk and their demographic characteristics are required. These requirements are considered to be critical to further research in the field of combat casualty care.

Finally, the high percentage of direct admissions to reporting medical facility reflects the speed of transport of casualties from the battlefield. The most common form of casualty removal from the battlefield was the helicopter (18). Most patients were transported directly to hospital ships or the Medical Support facility at Da Nang, bypassing the entire division medical service. This appears to have been a common occurrence throughout Vietnam (17). However, caution must be exercised in drawing this conclusion because of differences in reporting procedures of medical facilities and the lack of data on primary care in the battlefield. This limitation points to the need for better records of casualty care, especially in the field.

The high percentage of discharges from the reporting facility and the low percentage of deaths among hospitalized casualties reflects the speed of medical evacuation and the improved quality of care in comparison to earlier military conflicts. Henderson (16), for instance, reports that the percentage of Marine Corps personnel who died after receiving medical treatment (DOW) during World War II was 2.95%. Hardaway (17) reports that the mortality figures of injured patients in Army hospitals in Vietnam was roughly the same as was the case in Korea (2.4%). Our results indicate that among Marine Corps personnel in Vietnam, the mortality rate among injured patients was 1.4 percent.

While only descriptive in nature, the data presented in this paper reflect the demands placed on medical facilities in a military theater of operations. Battle injuries, of course, provide only one aspect of this demand. Future studies will concentrate on psychiatric casualties and disease and non-battle injuries (DNBI) among Navy and Marine Corps personnel in order to provide a complete picture of morbidity and mortality during military conflicts as well as an understanding of the relationship between combat casualties and other forms of morbidity.

FOOTNOTES

1. These figures reflect the first hospitalization for a battle-related wound or injury and not total hospital admissions. Although one individual may have more than one battle-related diagnosis, our figures include only the first time he is hospitalized for a unique diagnosis.
2. Casualties occurring prior to 8 March 1965 and April 1971 were primarily Marine Corps advisors to South Vietnamese units.

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infantrymen with one year or less of service. The First and Third Marine Divisions accounted for the majority of casualties. Multiple open wounds and open wounds of the lower limbs were the most common primary diagnoses. Bullets, mines, and booby traps were responsible for more than half of the wounds and injuries. Most casualties were treated at a naval hospital, hospital ship, dispensary, or the Naval Support Activity in Da Nang. Marine battalion aid stations and field hospitals accounted for the second largest percentage of casualties treated. The mortality rate of wounded patients was much lower than has been reported for Army casualties in Vietnam or casualties in previous conflicts.

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